Zoosyst. Evol. 98 (1) 2022, 55–63 | DOI 10.3897/zse.98.78202

PENSOFT

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# New records and a new cave-dwelling species of Agoristenidae (Arachnida, Opiliones) from Colombia

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*http://zoobank.org/F6DA8918-82B8-49C5-BD64-FE152C5D71BE*

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Academic editor: Danilo Harms ♦ **Received** 19 November 2021 ♦ **Accepted** 9 February 2022 ♦ **Published** 16 February 2022

## Abstract

Three species of *Avima* are recorded for the first time from Colombia (La Guajira department): *A. venezuelica* Soares & Avram, 1981, *A. troglobia* (Pinto-da-Rocha, 1996), and *A. wayuunaiki* **sp. nov.** Complementary and new descriptions of the species are offered and scanning electron microscopy photographs of the male genitalia of *A. troglobia* are given.

## Key Words

*Avima*, Caribbean, La Guajira, Laniatores, Leiosteninae

## Introduction

The family Agoristenidae is a small and unusual group of Neotropical harvestmen (27 genera and 78 described species), found mainly in leaf litter, under rotten logs and rocks, and over rocky walls (Ahumada-C. et al. 2020; García and Kury 2020). It is currently divided into three subfamilies: Agoristeninae Šilhavý, 1973, Leiosteninae Šilhavý, 1973 and Globibuninae Kury, 2012. Leiosteninae contains 13 genera and 60 species, distributed mainly in northern South America. In Colombia, the subfamily is represented by seven genera and nine species (García and Pastrana 2021, Kury et al. 2021, Villarreal and García 2021), two of them being members of *Avima* Roewer, 1949: *Avima scabra* (Roewer, 1963) and *Avima tuttifrutti* García & Pastrana, 2021, from Cundinamarca and Córdoba departments, respectively (García and Pastrana 2021).

In recent field trips to the Colombian Caribbean, three species of *Avima* were recognized, one new and two of them known previously from Venezuela (*Avima venezuelica* Soares & Avram, 1981 and *Avima troglobia* (Pinto-da-Rocha, 1996)). So, in the present work, we discuss some aspects of the harvestmen biodiversity of La Guajira and offer complementary and new descriptions, photographs of the general habitus, and SEM images of some of the male genitalia, together with a distributional map of the three species in Northern South America.

## Methods

The species were photographed using a Leica M205C stereoscope attached to a Leica DFC450 digital camera and were posteriorly edited in Photoshop CC 2014 software. Color descriptions use the standard names of the 267 Color Centroids of the NBS/IBCC Color System (Jaffer, 2001) as explained in Kury and Orrico (2006). Scanning Electron Microscopy (SEM) was carried out with a JEOL JSM-6390LV belonging to Rudolf Barth Electron Microscopy Platform of the Oswaldo Cruz Institute / Fiocruz (Rio de Janeiro, Brazil).

Geographic coordinates have been transcribed verbatim from the labels and may be in different formats; when there was no indication of coordinates, they were written between square brackets in decimal degrees,

based on Rodríguez and Galán (2008). The distribution map was made with QGIS 3.18 Zurich software (QGIS Development Team 2021). Colored shapes refer to WWF Terrestrial Ecoregions of the World (Olson et al. 2001).

Patterns of description follow García and Villarreal (2020) with modifications. The terminology for dorsal scutum outline types follows Kury and Medrano (2016), with the modifications explained in Villarreal and García (2021), and for chaetotaxy of penis lamina parva and truncus follows Kury and Villarreal (2015). Morphometric abbreviations are: **AL** (maximum abdominal scutum length), **AW** (maximum dorsal scutum width), **BaCh** (basichelicerites length), **ChL** (chelicera length), **CL** (carapace length), **CW** (maximum carapace width), **DS** (dorsal scutum), **DSL** (dorsal scutum length), **Fe** (femur), **LP** (lamina parva), **MS** (macrosetae of penis), **Mt** (metatarsus), **Pa** (patella), **Ta** (tarsus), **Ti** (tibia), **TL** (total length), **Tr** (trochanter). All measurements are in mm unless otherwise noted.

Abbreviations of the cited repositories are: **CBUDC** (Colección de Ejemplares Biológicos de la Universidad de Cartagena. Cartagena de Indias, Colombia); **ICN** (Instituto de Ciencias Naturales, Universidad Nacional de Colombia. Bogotá, Colombia); **MBUZ** (Museo de Biología de La Universidad del Zulia. Maracaibo, Venezuela); **MNRJ** (Museu Nacional, Universidade Federal do Rio de Janeiro. Rio de Janeiro, Brazil); **MUSENUV** (Museo de Entomología de la Universidad del Valle. Cali, Colombia); **MZUSP** (Museu de Zoologia da Universidade de São Paulo. São Paulo, Brazil). The MNRJ material destroyed by the fire in September 2018 is marked with an exclamation mark (!).

# Results

## Systematics

**Order Opiliones Sundevall, 1833**
**Suborder Laniatores Thorell, 1876**
**Superfamily Gonyleptoidea Sundevall, 1833**
**Family Agoristenidae Šilhavý, 1973**
**Subfamily Leiosteninae Šilhavý, 1973**

### Genus *Avima* Roewer, 1949

*Avima* Roewer, 1949: 58, fig. 112; Soares & Avram, 1982: 26 (type SMF 1533/8, male holotype). A complete synonymic list may be found in Villarreal and Kury (2009).

**Type species.** *Avima leucobunus* Roewer, 1949.

### *Avima wayuunaiki* sp. nov.

http://zoobank.org/42360820-446E-4054-B0DB-CF52D6DE4317

Figs 1–3, 6A, C

**Type data.** COLOMBIA• ♂ holotype: La Guajira, Hatonuevo, Cerro Bañaderos, cueva [Luis Pablo Ojeda]; 11°7'51.5"N, 72°47'23.9"W [11.130972°, -72.789972°]; 978 m a.s.l.; 14 July 2015; CarBio Team 17 leg.; ICN-Ao-1976 • 7 ♂ 10 ♀: same data as holotype; ICN-Ao-1718 • 1 ♂ 1 ♀: same data as holotype; MUSENUV-Ar 2102 • 4 ♂ 2 ♀: same locality as holotype, vereda Bañaderos; cueva [Luis Pablo Ojeda]; 11°7'33.3"N, 72°47'06.9"W [11.125899°, -72.785241°]; 785 m a.s.l.; 19 May 2018; Miguel Gutiérrez leg.; MNRJ 283 • 2 ♀: same locality as previous; CBUDC-ARA 335.

**Description. Male *Holotype*** (ICN-Ao-1976). Measurements. TL (ChL+DSL): 4.45, DSL: 2.66, CL: 1.07, CW: 1.79, AL: 1.59, AW: 2.21, BaCh: 0.55. Pedipalp: Tr: 0.60, Fe: 1.23, Pa: 0.72, Ti: 0.88, Ta: 0.70, Claw: 0.79. Leg I: Tr: 0.42, Fe: 4.10, Pa: 0.73, Ti: 3.19, Mt: 5.86, Ta: 1.31, TL: 15.61; Leg II: Tr: 0.57, Fe: 9.21, Pa: 0.98, Ti: 7.67, Mt: 12.40, Ta: 5.14, TL: 35.97. Leg III: Tr: 0.62, Fe: 5.92, Pa: 0.97, Ti: 3.65, Mt: 7.52, Ta: 1.58, TL: 20.26. Leg IV: Tr: 0.70, Fe: 8.65, Pa: 1.00, Ti: 4.85, Mt: 11.14, Ta: 1.82, TL: 28.16.

***Dorsum.*** DS Epsilon type 2. Anterior and lateral margins of DS smooth. Ocularium low, smooth, and without median concavity (Fig. 1A, B, E). Mesotergum slightly delimited, divided into four smooth areas: area I divided into two halves; areas II–IV undivided (Fig. 2A). Posterior margin of scutum substraight and with few granules (Figs 1D, 2B). Free tergites I-III with some granules (Fig. 1B, D, E).

***Venter.*** Coxa I with a longitudinal row of tubercles and one large bicapitate tubercle on the anteroproximal margin (Fig. 2C); coxae II-IV with some granules; coxa II longer than coxa I; coxa III longer than coxae I and II; coxa IV backward projected. Stigmata oval, small and transverse (Fig. 1C).

***Chelicera.*** Chelicera swollen. BaCh quadrate in dorsal view, with well-marked bulla, three mesal, five anterior, and three ectal tubercles. Hand with setiferous tubercles of different sizes reaching the medial and posterior region. Fixed finger with the inner surface finely grooved. Movable finger with one trapezoid, small, sub-basal tooth, and with a dentate distal inner surface (Fig. 2D).

***Pedipalps.*** All segments more slender than usual (Fig. 1B). Trochanter with one subapical tubercle on the ventral face. Femur with a ventroectal row of four setiferous tubercles (the two basalmost largest and the two distalmost medium-sized), and one large ventromesal setiferous tubercle in the apical portion (Fig. 2E). Patella with one large mesal setiferous tubercle. Tibia ectal III, mesal IIi. Tarsus ectal IIi, mesal IIi.

***Legs.*** Increasing in thickness from leg I to leg IV, all smooth (Fig. 1A). Leg I filiform; coxae I-III with one dorsoanterior and one dorso-posterior tubercle; Coxa IV with some prolaterodistal tubercles; Fe III-IV darker than I-II. Fe IV length three and a half times DS length (Fig. 1A); Ta I-II each with one smooth claw; Ta III-IV with two subparallel smooth claws and without tarsal process. Tarsal counts: 9(3)-9(3)/19(3)-18(3)/7-6/7-7.

***Penis.*** LP small (width twice the height) and apically depressed, with anterolateral acute corners (crescent-shaped) apically pointed (Fig. 3A–E). Malleus with two

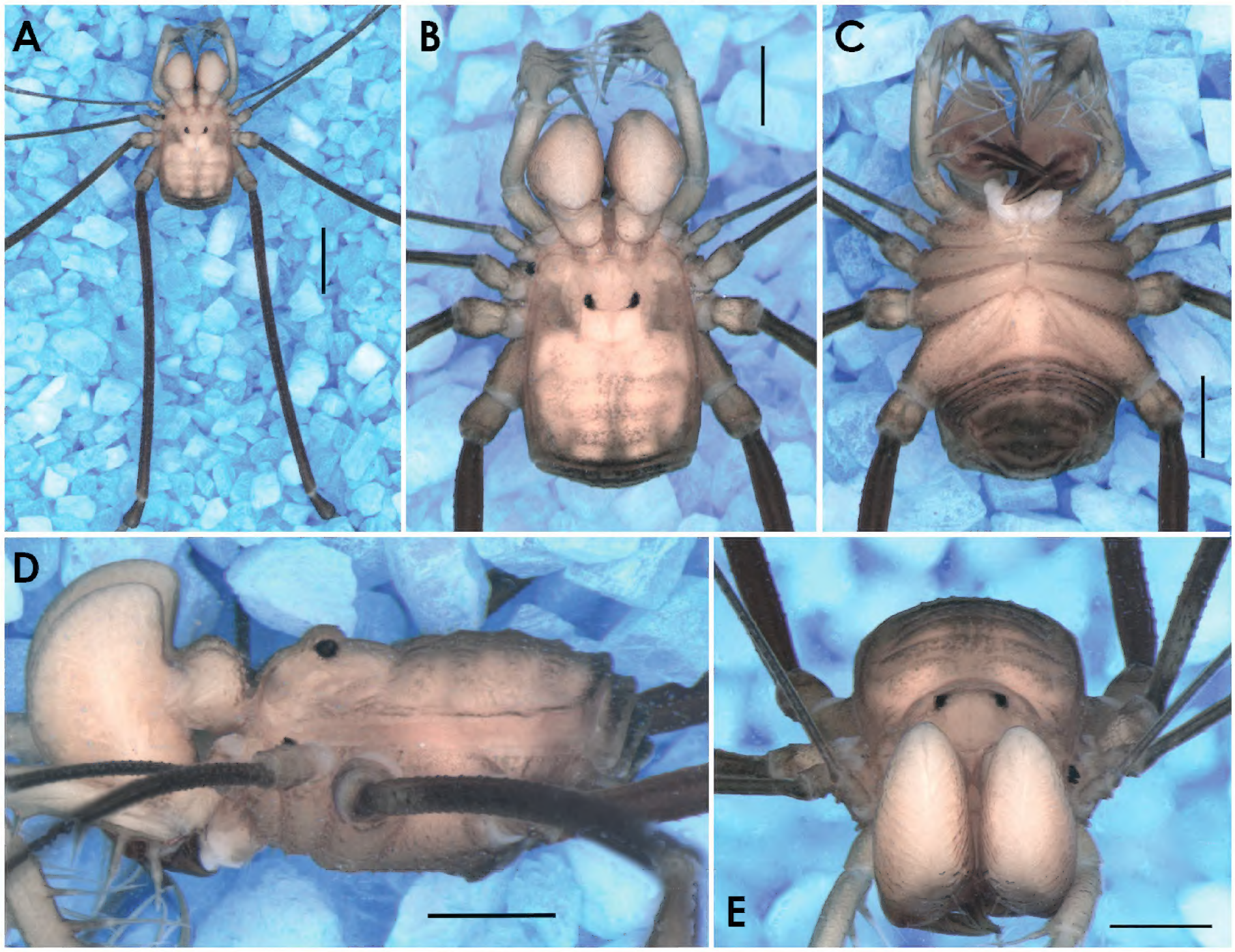


**Figure 1.** *Avima wayuunaiki* sp. nov. (ICN-Ao-1976), male holotype. Habitus in panoramic (**A**), dorsal (**B**), ventral (**C**), lateral (**D**), and frontal (**E**) views. Scale bars: 2 mm (**A**); 1 mm (**B–E**).

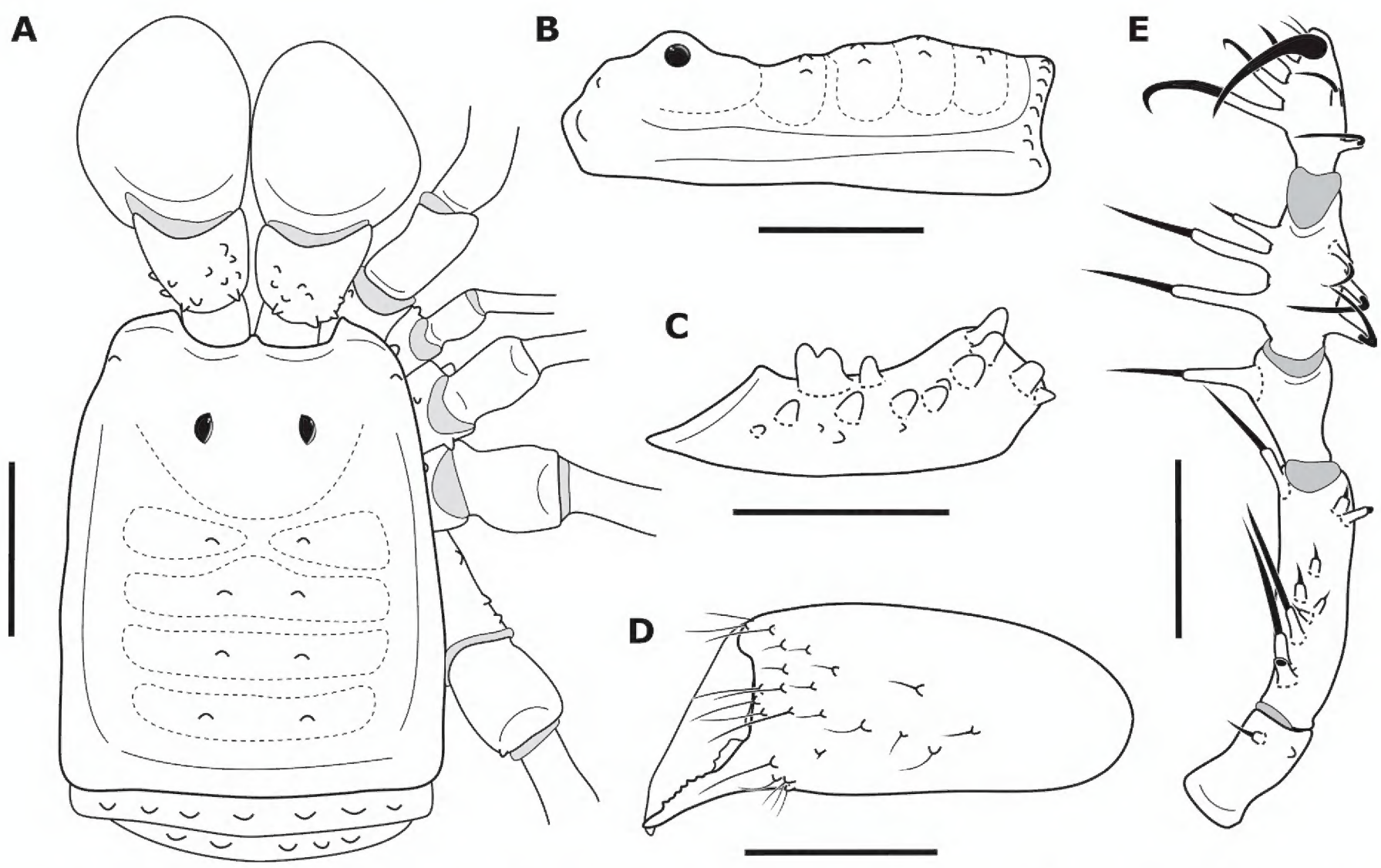


**Figure 2.** Drawings of *Avima wayuunaiki* sp. nov. (ICN-Ao-1976), male holotype. Habitus in dorsal (**A**) and lateral (**B**) views. Left coxa I in ventral view (**C**). Right chelicera in frontal view (**D**). Left pedipalp in ventral view (**E**). Scale bars: 1 mm (**A, B, D, E**); 0.5 mm (**C**).

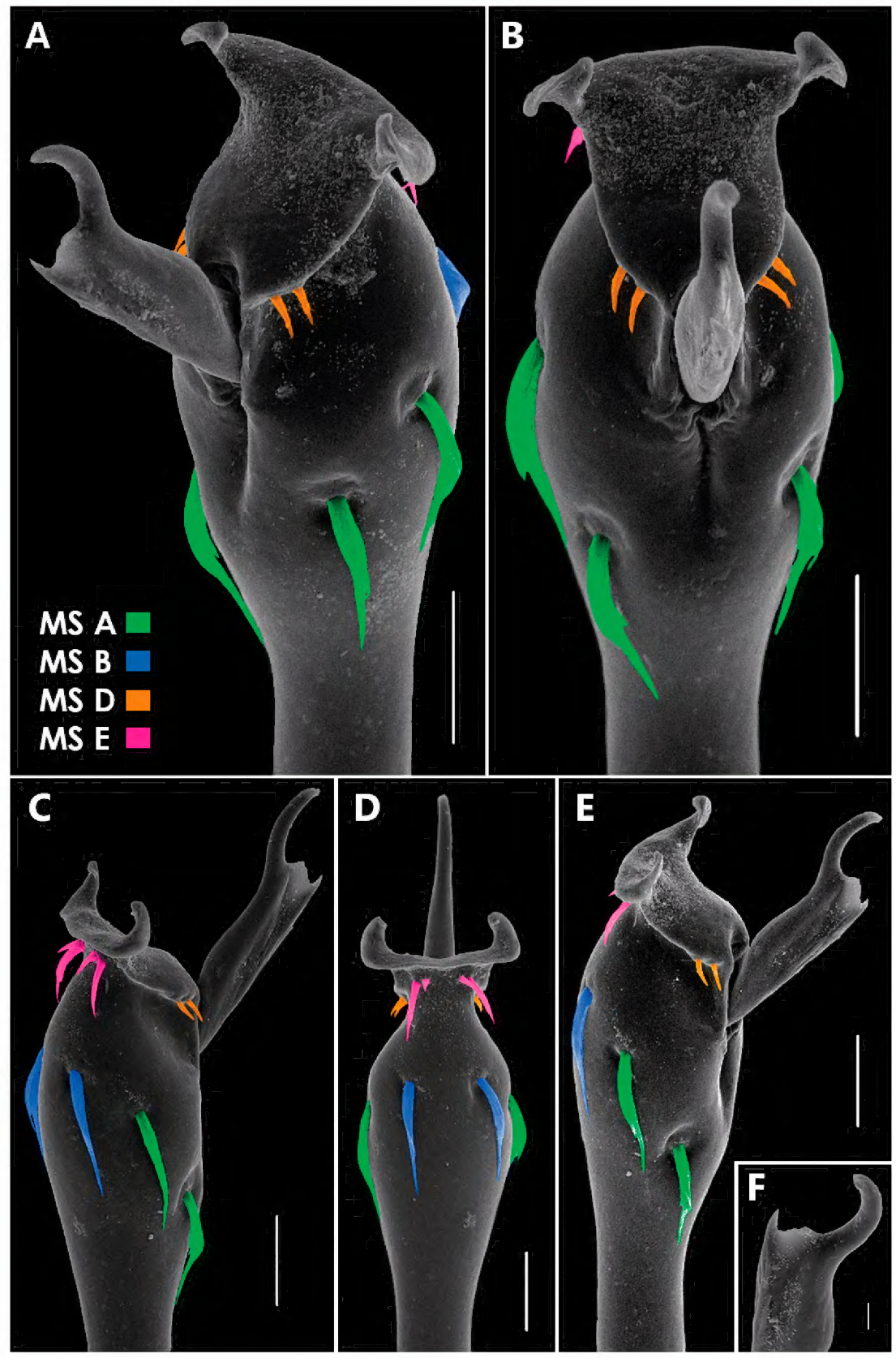


**Figure 3.** SEM of the male genitalia of *Avima wayuunaiki* sp. nov. (ICN-Ao-1718), paratype. Distal portion of the penis in lateroapical (**A**), dorsoapical (**B**), lateral (**C**), ventral (**D**), and oblique (**E**) views; detail of stylus in lateral view (**F**). Abbreviations: MS = Macrosetae. Scale bars: 50 μm (**A–E**); 10 μm (**F**).

pairs of branched MS-A, being MS-A2 far from the base of the stylus; one pair of branched MS-B; MS-C absent; two pairs of medium-sized MS-D located in a keel between the dorsal region of the LP and the base of the stylus (Fig. 3A–C, E); MS-E2 large and branched, MS-E1 short and conical, located slightly distal to MS-E2 on the ventral side of the LP (Fig. 3C, D). Stylus elongated, mostly straight (concave at the apex), and surpassing the LP; dorsal keel present, smooth, elevated at the medial region, with a dorsoapical sharp projection; tip dorsally projected (Fig. 3E, F).

***Color (in alcohol).*** DS and chelicerae Light Yellow (86). Pedipalps, coxae, and trochanters I–IV Pale Yellow (89). Femora to tarsi I–IV Dark Yellowish Brown (78) (Fig. 1).

**Female.** Paratype (ICN-Ao-1718). Similar to male, except for abdomen wider at areas II-III, chelicerae not swollen, and leg IV slender. Measurements: TL (Ch+DSL): 3.50, DSL: 2.35, CL: 0.96, CW: 1.61, AL: 1.39, AW: 1.96, BaCh: 0.42. Pedipalp: Tr: 0.41, Fe: 1.12, Pa: 0.65, Ti: 0.84, Ta: 0.79, Claw: 0.78. Leg I: Tr: 0.32, Fe: 4.27, Pa: 0.69, Ti: 3.19, Mt: 6.04, Ta: 1.29, TL: 15.8; Leg II: Tr: 0.39, Fe: 9.53, Pa: 0.98, Ti: 8.70, Mt: 12.14, Ta: 5.34, TL: 37.08. Leg III: Tr: 0.39, Fe: 9.36, Pa: 1.04, Ti: 5.77, Mt: 13.25, Ta: 1.51, TL: 31.32. Leg IV: Tr: 0.68, Fe: 8.70, Pa: 0.94, Ti: 4.83, Mt: 11.08, Ta: 1.80, TL: 28.03. Tarsal counts: ?-6(3)/? -18(3)/6-6/7-6.

**Etymology.** Wayuunaiki is the language spoken by the indigenous Wayuu people in northwestern Venezuela and northeastern Colombia on the Guajira Peninsula, where the species was collected. Noun in apposition.

**Natural history.** Specimens of *A. wayuunaiki* sp. nov. were found inside a cave (Fig. 6B, C) in the northeastern slopes of Sierra Nevada de Santa Marta. This species lives sympatrically with *Loxosceles guajira* Cala-Riquelme, Gutiérrez-Estrada & Flórez, 2015 (Sicariidae) and *Trichomycterus spectrum* DoNascimiento & Prada-Pedreros, 2020 (Trichomycteridae).

### *Avima troglobia* (Pinto-da-Rocha, 1996)

Figs 4, 6A

*Trinella troglobia* Pinto-da-Rocha, 1996: 321, figs 4, 8, 15–16; Kury, 2003: 34.

*Avima troglobia* (Pinto-da-Rocha, 1996): Villarreal & Kury, 2009: 67.

**Type material.** VENEZUELA• 1 ♂ holotype and 3 ♀ paratypes: Zulia, rio Socuy, cueva de Los Laureles; [10.751 -72.462]; 750 m a.s.l.; 20 Dec. 1990; J. Camacho and A. Viloria leg.; MBUZ• 2 ♀ paratypes; same data as previous [in the original label says Sierra de Perijá]; MZSP-1457 • paratype; same data as previous; 16 Dec.1992; P. Gnaspini and E. Trajano leg.; MZSP-14578• 2 ♀ paratypes; same data as previous, Cueva La Carlotica; 760 m a.s.l., 21 Dec.1990; J. Camacho, A. Viloria and T. Barros leg.; MBUZ• 1 ♀ paratype; same data as previous; MNRJ 5472[1].

**New records.** COLOMBIA• 3 ♀: La Guajira, Barrancas, corregimiento San Pedro, Las Pavas; Cueva, finca La Fortuna; 10°50'04.8"N, 72°40'34.4",W [10.834667 -72.676222]; 1731 m a.s.l.; 8 May 2018; Miguel Gutiérrez leg.; ICN-Ao-1978• 1 ♂ 1 ♀; same data as previous; MNRJ 59052. First records for the country.

**Complementary description.** ***Body***. DS Epsilon type 1. Ocularium low, domed, smooth, and without eyes (Fig. 4D, F) Mesotergum divided into four ill-defined areas, smooth; (Fig. 4A–C). Areas I–IV with a pair of minute paramedian granules; area I divided into two halves; area II–IV undivided (Fig. 4A, D). Posterior border of scutum substraight. Free tergites I–III with some tubercles. ***Venter.*** Stigmatic area with a few granules. Stigmata large, oval and oblique (Fig. 4E). ***Legs***. Increasing in thickness from leg I to leg IV, but legs III and IV at least twice as thick as legs I and II, unarmed. Leg I filiform. Leg IV with darker coloration than the others. Fe IV length four times DS

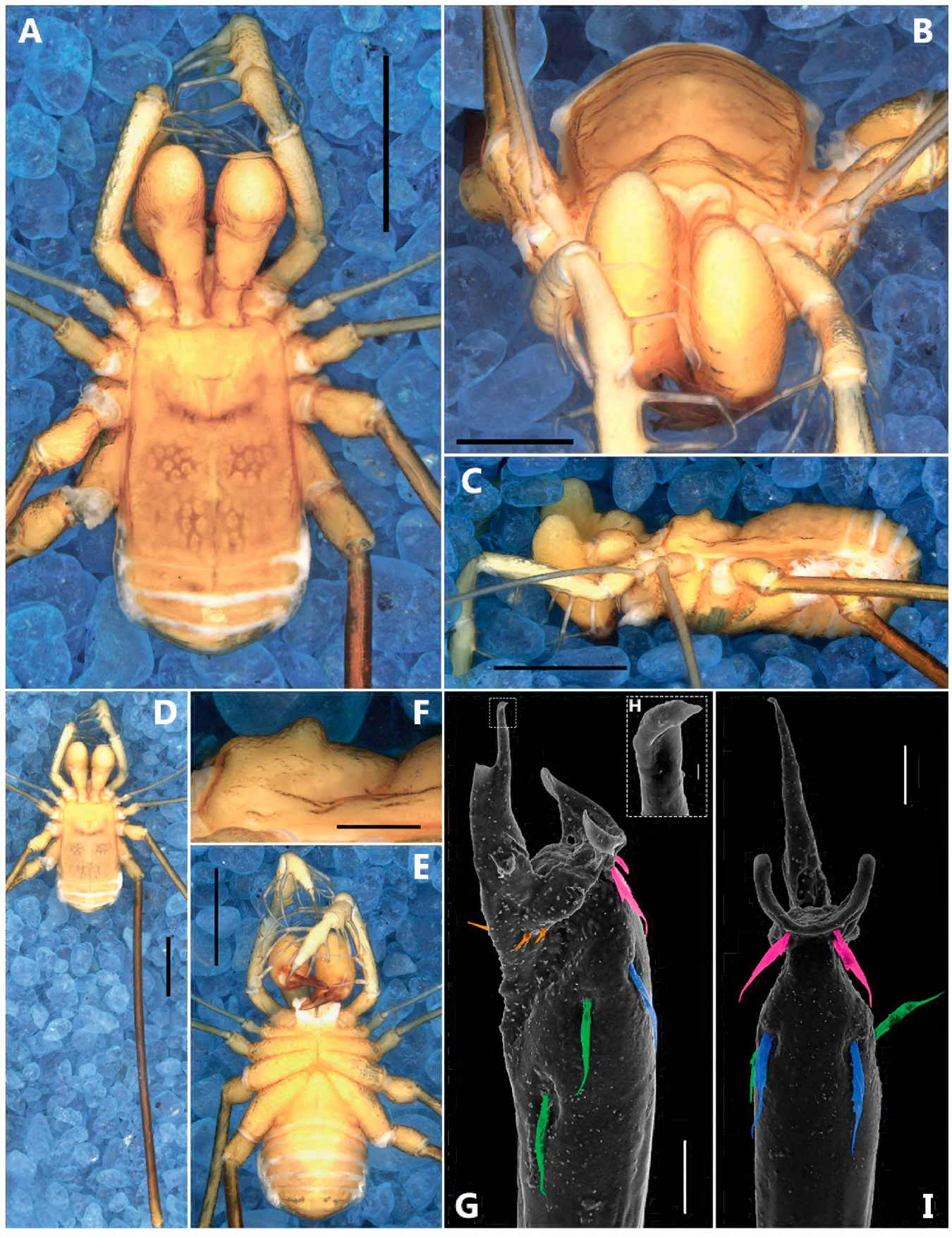


**Figure 4.** *Avima troglobia* (Pinto-da-Rocha, 1996) (MNRJ 59052), male. Habitus in dorsal (**A**), frontal (**B**), lateral (**C**), panoramic (**D**), and ventral (**E**) views; detail of ocularium showing the eye absence (**F**). SEM of the penis in lateral (**G**) and ventral (**I**) views; detail of the tip of the stylus (**H**). Scale bars: 2 mm (**A–F**); 50 µm (**G, I**), 2 µm (**H**). Macrosetae colors: **A.** = green, **B.** = blue, **D.** = orange, **E.** = magenta.

length (Fig. 4D). ***Penis.*** LP small and depressed, crescent-shaped, with anterolateral rounded corners apically pointed (Fig. 4G, I). Hammer (malleus) cylindrical, carrying MS-A-B (two pairs of MS-A and one pair of MS-B, all branched) (Fig. 4G, I); MS-C absent; two pairs of short MS-D located in a keel between the LP and the base of the stylus (Fig. 4G). MS-E1 large and triffid, MS-E2 short and conical, located slightly distal to MS-E1 on the ventral side of the LP (Fig. 4G, I). Stylus straight, elongated, surpassing the LP (Fig. 4G, I), with the tip ventrally curved (Fig. 4H) and a rectangular dorsal keel (Fig. 4G). ***Coloration (in alcohol).*** Carapace Brilliant Yellow (83) (anterior border) and Brilliant Orange Yellow (67) (posterior border and laterals). Free tergites and chelicerae Brilliant Orange Yellow (67). Pedipalps and legs I-III Brilliant Yellow (83). Leg IV Deep Orange Yellow (69). ***Sexual dimorphism.*** Chelicerae hypertelic in males.

**Natural history.** *A. troglobia* was collected exclusively in a cave and shows troglomorphisms (e.g., depigmentation, lack of eyes (Fig. 4F)), in the same way as the individuals from the Venezuelan caves, corroborating the idea that it is an obligatory cave-dwelling species (Pinto-da-Rocha, 1996).

## *Avima venezuelica* Soares & Avram, 1981

Figs 5, 6A

*Avima venezuelica* Soares & Avram, 1981: 95; Villarreal & Kury, 2009: 67
*Vima venezuelica*: González-Sponga, 1987: 543, fig. 708–713.
*Trinella venezuelica*: Pinto-da-Rocha, 1996: 323; Kury, 2003: 34.

**Type Locality.** VENEZUELA• Zulia, río Guasare, cueva de Cerro Verde; [10.725000 -72.620000]. Remark. It is in Zulia, not Falcón, as in the original description

**Records.** VENEZUELA• Zulia, Mara, cueva de los Gavilanes [or Mara]; [11.017000 -72.425000]; 200 m a.s.l. • Maracaibo, cueva Francisco Zea; [10.758000, -72.609000]; 360 m a.s.l.

**New records.** COLOMBIA• 2 ♀: La Guajira, Barrancas, corregimiento San Pedro, Las Pavas, camino a la cueva, finca La Fortuna; 10°50'27.9",N 72°40'23.9",W [10.841083 -72.673306]; 1529 m a.s.l., 4 July 2016; Miguel Gutiérrez leg.; ICN-Ao-1979; 1 ♀: same data as previous, MNRJ 59053. First records for the country.

**Complementary description.** DS Epsilon type 2. Ocularium low, smooth, and with median concavity

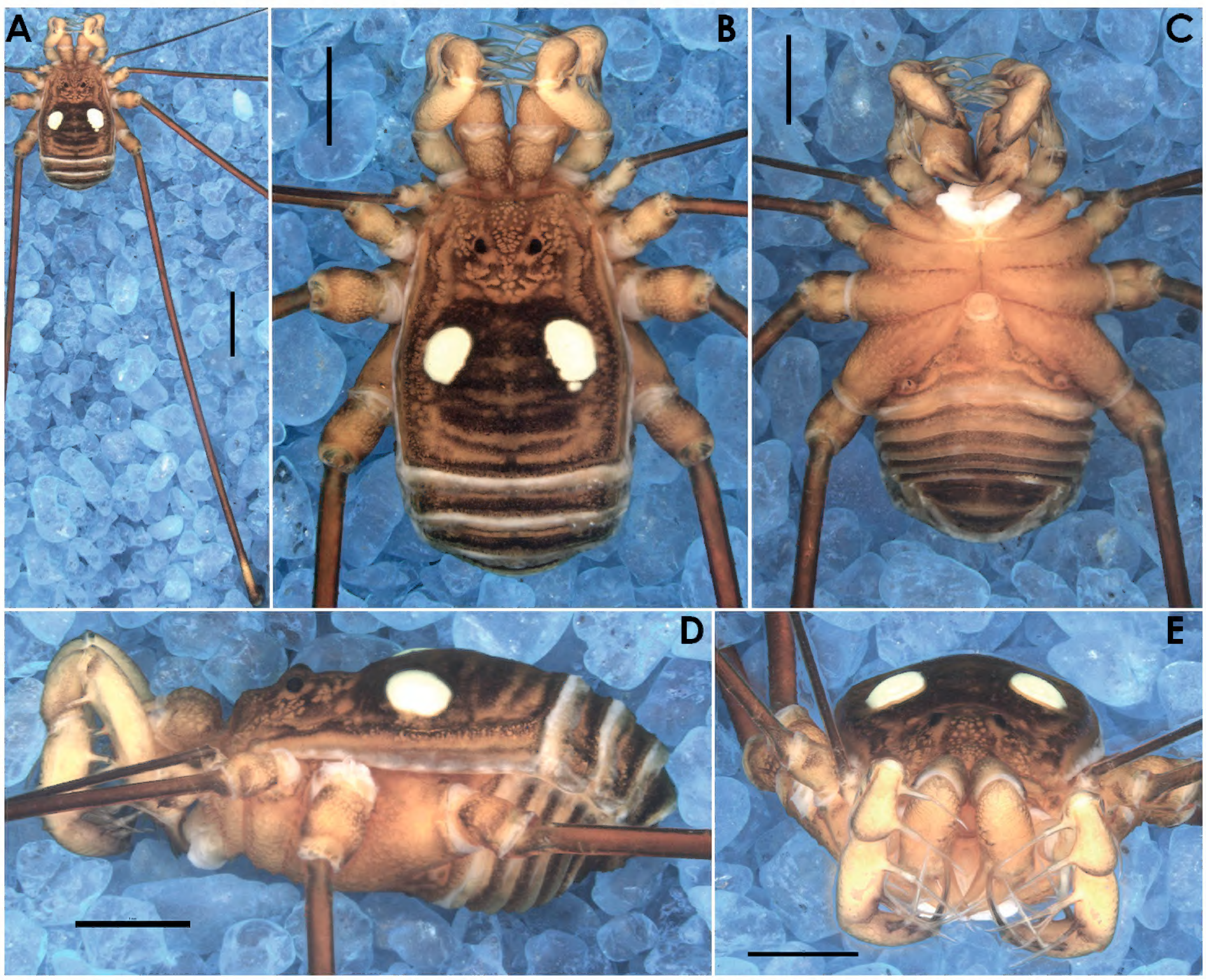


**Figure 5.** *Avima venezuelica* Soares & Avram, 1981 (MNRJ 59053), female. Habitus in panoramic (**A**), dorsal (**B**), ventral (**C**), lateral (**D**), and frontal (**E**) views. Scale bars: 2 mm.

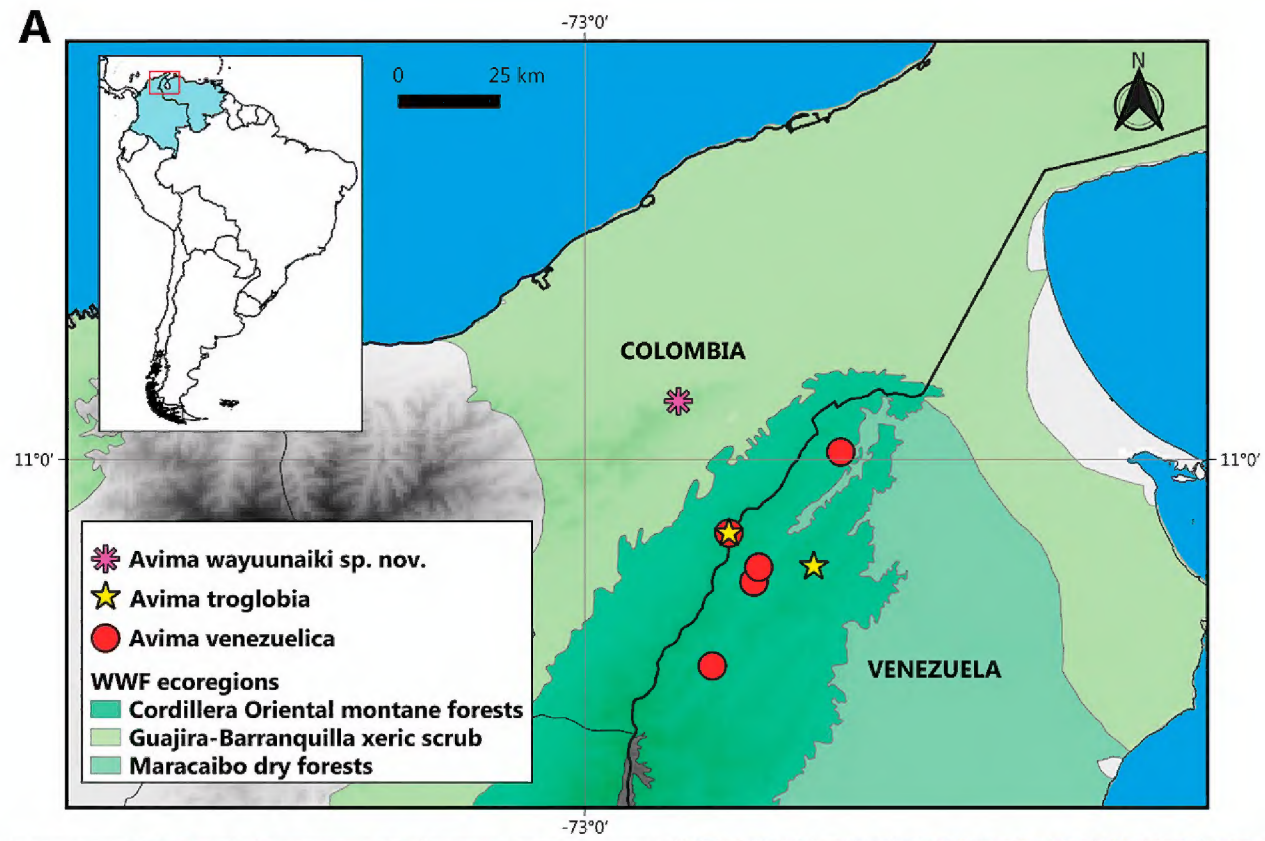


**Figure 6.** Geographic distribution of *Avima venezuelica*, *Avima troglobia* and *Avima wayuunaiki* sp. nov. in Northern South America. **A.** Map with previous and new records of the species in Colombia and Venezuela (colored areas represent the WWF ecoregions (Olson et al. 2001)); **B.** Bañaderos cave in La Guajira (Colombia), habitat of *A. wayuunaiki* sp. nov.; **C.** Living specimen of *A. wayuunaiki* sp. nov. Photographs by Miguel Gutiérrez Estrada (**B**), and Alex González Vargas (**C**).

(Fig. 5B, E). Mesotergum delimited, divided into four areas: area I divided into two halves; areas II-IV undivided (Fig. 5B). Anterior margin of coxa I with three tubercles, the basalmost bifid, and a medial longitudinal row of small tubercles (Fig. 5C). Pedipalpal segments slender and with long setae (Fig. 5B–D). Legs increasing in thickness from leg I to leg IV, unarmed; leg I filiform. Fe IV four times DS length (Fig. 5A).

**Natural history.** *A. venezuelica* was found outside the cave where *A. troglobia* was collected, as previously noted by Pinto-da-Rocha (1996) for the same species in Venezuelan caves.

## Discussion

*Avima* is the largest genus of Leiosteninae (34 spp.), representing an entangled miscellany of taxa whose monophyly has not been tested (Villarreal and Kury 2009; García and Villarreal 2020; García and Pastrana 2021). For that reason, we decided to review the harvestmen literature looking for other species of Leiosteninae and *Avima* whose morphology could be related to *A. wayuunaiki* sp. nov., *A. venezuelica* and *A. troglobia*; we found similarities with Andean species like *Avima chiguaraensis* (González-Sponga, 1987), and some cave-dwelling species such as *Avima azulitai* (Rambla, 1978), *Avima bordoni* (Muñoz-Cuevas, 1975), *Avima checkeleyi* (Rambla, 1978), *Avima chapmani* (Rambla, 1978), and *Avima falconensis* (González-Sponga, 1987).

According to the original descriptions and redescriptions of the aforementioned species, we found that they are typically (1) large to very large animals (DS + Leg IV length = more than 30 mm); have (2) a low and smooth ocularium (except in *A. chiguaraensis*), without a median concavity; have (3) more or less rounded corners of the LP of the penis and (5) stylus with a longitudinal dorsal expansion (apparently reduced in *A. bordoni*, *A. falconensis*, and *A. troglobia*).

Interestingly, the male genitalia of *A. wayuunaiki* sp. nov. is very similar to that of *A. azulitai* (González-Sponga, 1987: 501, figs 640–641) and *A. chiguaraensis* (González-Sponga, 1987: 513, figs 658–659), sharing the same macrosetae composition and a smooth dorsal keel with an elevated medial region with a dorsoapical sharp projection, reinforcing our idea of some systematic affinities between them. However, further analysis (perhaps including the revision of the type material of *A. azulitai* and *A. chiguaraensis*), will shed more light on this relationship.

## About the localities in La Guajira

La Guajira department exhibits a contrasting assemblage of climatic and geographic conditions that make it an interesting region for ecological and biological studies. The majority of its territory is dominated by the Guajira-Barranquilla xeric scrub ecoregion (NT1308), characterized by low precipitation rates and thorn-covered trees and succulent plants as dominant vegetation (World Wide Foundation 2014a). The southeast area exhibits forests of Cordillera Oriental montane forests ecoregion (NT0118), with a predominance of subarboreous and bushy strata, particularly Perijá Mountains sub-ecoregion (World Wide Foundation 2014b) (Fig. 6A). The cave where the new species was collected is located in the latter but is influenced by the humid forests of Sierra Nevada de Santa Marta ecoregion (NT0159), which has many endemic species due to its isolation from the Cordillera Oriental mountain range (World Wide Foundation 2014c). Unfortunately, all of these ecoregions have been changed due to deforestation by extensive pastures and the removal of firewood and timber.

Recent efforts to record the biodiversity of these ecoregions (e.g. particular collections done by the third author of the present work plus rapid faunistic inventories developed by the CarBio team), resulted in the description of new spider taxa (e.g. Cala-Riquelme et al. 2015, 2017, 2018; Cala-Riquelme and Salgado 2021), from both Cesar and La Guajira departments. In the case of harvestmen, material collected from those expeditions led to the description of *A. wayuunaiki* sp. nov. from a cave in NT1308 (Fig. 6B), and the new records of *A. troglobia* and *A. venezuelica* (which are the first published photographs of both species) from NT0118, in La Guajira (Fig. 6). Such findings show that our knowledge about the opilionofauna of this region is incipient, especially considering that the only recorded harvestman from La Guajira to date was *Cranaus albipustulatus* Roewer, 1943 (Cranaidae) (Kury 2003; Ahumada-C. et al. 2020) and no further collection efforts had been made in the region since then. Therefore, we believe that new studies in La Guajira and its ecoregions could reveal hidden diversity and help in conservation initiatives and efforts.

## Acknowledgements

We are grateful to Eduardo Flórez (ICN, Bogotá) for the loan of the material here studied, Adriano Kury (MN/UFRJ, Rio de Janeiro) for all the laboratory facilities, and Brittany Damron for the English revision of the text. The photographs were taken with the stereomicroscope (CNPq Universal 14/2013) in the Invertebrate department (MNRJ). The SEM micrographs were taken in the Microscopy Platform Rudolf Barth/IOC-Fiocruz with the kind assistance of Roger Magno Macedo Silva. The OmniPaper Project created and maintained by Adriano Kury was very helpful in providing access to some papers. The suggestions of Willians Porto (MACN) and one anonymous referee greatly improved the present work. This study has been supported by a scholarship from the Coordenação de aperfeiçoamento de pessoal de nível superior (CAPES) and the scholarship #E-26/204.248/2021 from Carlos Chagas Filho Foundation for Research Support of the State of Rio de Janeiro (FAPERJ) to AFG.

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